

REMARKS

In this communication, Applicant has amended Claims 1 and 31. No new matter is introduced. Claims 1-35 are pending. Allowance of all pending claims is respectfully requested.

Rejections under 35 U.S.C. § 102

Claims 1-3, 5-7, and 10-12 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,980,018 to Mu et al. (hereinafter “Mu”) for reasons stated on page 3 of the Office Action. Applicant respectfully traverses the rejection.

For anticipation under 35 U.S.C. §102, the reference “must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present.” (MPEP §706.02). “ A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” Verdegaal Bros. v. Union Oil Co. of California, 631 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Independent Claim 1, as amended, is directed to a method for etching a semiconductor device to form an etched pattern therein, comprising: (a) providing an unetched semiconductor device having a plurality of layers, at least one of the layers of the semiconductor device comprising a refractory metal-containing material; and (b) etching the unetched semiconductor device with a first etchant chemistry which comprises a chlorine source free of BCl_3 and a fluorine source, followed with a second etchant chemistry which is free of fluorine.

Mu describes a three-step etching process using three different etchant chemistries. The first etchant chemistry containing SF_6 , O_2 and He. The second etchant chemistry containing SF_6 , Cl_2 and He. The third etchant chemistry containing Cl_2 and He. While the first etchant chemistry recited in Claim 1 contains a chlorine source, the first etchant chemistry in Mu does

not comprise a chlorine source. The Examiner alleges that the first etchant chemistry is anticipated by the second etchant chemistry of Mu. Applicant respectfully disagree. In view of the specification, Claim 1 clearly recites that the semiconductor device is first etched by the first etching chemistry. In other words, the unetched semiconductor device is first exposed to the etchant chemistry having a chlorine source and a fluorine source. In Mu, the unetched semiconductor device is first exposed to an etchant chemistry that **does not** have a chlorine source. Accordingly, Applicant respectfully submits that Claim 1 is not anticipated by Mu because Mu does not teach each and every element of the claimed invention. Applicant further submits that Claims 2, 3, 5-7 and 10-12 are not anticipated by Mu because they depend from Claim 1. Withdrawal of the 35 USC 102(b) rejection is respectfully requested.

Rejections under 35 USC 103

Claims 13-18, 20, 21, 24, 25, and 29-35 stand rejected under 35 USC 103(a) as being unpatentable over Mu in view of U.S. Patent No. 4,713,141 to Tsang (hereinafter "Tsang") and U.S. Patent No. 6,277,763 to Kugimiya et al. (hereinafter "Kugimiya") for reasons stated on page 3 of the Office Action. Applicant respectfully traverses the rejection.

To establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 1385, 165 USPQ 494, 496 (CCPA 1970).

In addition, when applying 35 U.S.C. 103, the following tenets of patent law must be adhered to: (A) The claimed invention must be considered as a whole; (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; (C) The references must be viewed without the benefit of impermissible

hindsight vision afforded by the claimed invention; and (D) Reasonable expectation of success is the standard with which obviousness is determined. Hodosh v. Block Drug Co., Inc., 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

As admitted by the Examiner, Mu describes the source power but does not describe the bias power. Tsang is directed to a method of etching tungsten metal film with a single gas chemistry of SF₆ and Cl₂. Tsang describes that “although the preferred embodiment utilizes a single wafer, parallel-plate plasma etcher, most any prior etcher may be utilized, such as batch etchers and reactive ion etchers...” (col. 2, line 66 to col. 3, line 4).

Kugimiya also describes a single step etching method for etching a substrate comprising a tungsten layer overlying polysilicon. The method uses a etchant chemistry comprising a fluorinated gas and oxygen. Kugimiya discloses that the etch process can be reduced to practice in a number of etching systems capable of plasma processing tungsten and one such system is a Decoupled Plasma Source (DPS) Centura etch system. Kugimiya further discloses that the source power can be between about 100 to 1000 watts and that the bias power can be about 10 to 300 watts.

As discussed above, Mu does not teach a etch process using a first etchant chemistry having a chlorine source and a fluorine source (Mu does not have chlorine source in the first etchant), and a second etchant chemistry that is free of fluorine (Mu has fluorine in the second etchant), as recited in independent Claims 1, 15 and 31. Tsang and Kugimiya do not cure the defect of Mu because both references are directed to a etching process using only one etchant chemistry. For this reason alone, Claims 1, 15 and 31 are not *prima facie* obvious over Mu, Tsang and Kugimiya. Accordingly, Claims 13, 14, 16-18, 20, 21, 24, 25, 29, 30, and 32-35 are not obvious over Mu, Tsang and Kugimiya because they depend from Claim 1, 15 or 31, and contain additional patentable subject matter.

Moreover, the Examiner has not established the requisite motivation or suggestion for the proposed combination of references. Mu uses a commercially available single wafer etcher as the preferred equipment in the three-step etching process. Tsang uses a single wafer etcher as a preferred equipment in a one-step etching process. Kugimiya uses a DPS etcher in a one-step etching process. There is no motivation and hence no desirability for one skilled in the art to replace the preferred equipment in Mu with the etcher of Kugimiya which was used in a different procedure. Applicant would like to bring the Examiner's attention to a recent decision by the Board of Patent Appeals and Interferences, in which the Board held that the examiner had not established why one of ordinary skill in the art would have desired the water resistant coating of reference #1 in place of the water resistant coating of reference #2 when both references teach that their corresponding coating is economical and water resistant, and the ingredients of the coating composition were not the same or similar (Ex parte Richard, Appeal No. 2003-1885, 2004). In the instant case, Mu, Tsang or Kugimiya each teaches a preferred etcher that fits the desired purpose, and the etching processes taught in each reference are not the same. Applying the Board's analysis in Ex parte Richard, there would be no desirability for one of ordinary skill in the art to replace the single wafer etcher in Mu with the DPS etcher in Kugimiya. Accordingly, Applicant respectfully submits that Claims 13-18, 20, 21, 24, 25, and 29-35 are not obvious over Mu, Tsang and Kugimiya. Withdrawal of the 103 rejection to Claims 13-18, 20, 21, 24, 25, and 29-35 is respectfully requested.

Claims 4, 8, 19, and 22 stand rejected under 35 USC 103(a) as being unpatentable over Mu or Mu/Tsang/Kugimiya for reasons stated on pages 3-4 of the Office Action. Applicant respectfully traverses the rejection.

As discussed above, Mu, Tsang and Kugimiya, individually or in combination, do not render independent Claims 1 and 15 obvious. Claims 4 and 8 depend from Claim 1. Claims 19

and 22 depend from Claim 15. Accordingly, Applicant respectfully submit that Claims 4, 8, 19 and 22 are not obvious over Mu, Tsang and Kugimiya. Withdrawal of the 103 rejection to Claims 4, 8, 19, and 22 is respectfully requested.


Claims 9, 23, and 26-28 stand rejected under 35 USC 103(a) as being unpatentable over Mu or Mu/Tsang/Kugimiya and further in view of U.S. Patent No. 5,626,775 to Roberts et al. (hereinafter "Roberts"), for reasons stated on pages 4-5 of the Office Action. Applicant respectfully traverses the rejection.

As discussed above, Mu, Tsang and Kugimiya, individually or in combination, do not render independent Claims 1 and 15 obvious. Roberts describes a single step etching method using a etching chemistry comprising trifluoroacetic acid, trifluoroacetic anhydride, trifluoromethyl ester of trifluoroacetic acid, trifluoroacetic amide and mixtures thereof. Roberts does not teach or suggest a etch process using a first etchant chemistry comprising a chlorine source free of BCl_3 and a fluorine source, followed with a second etchant chemistry that is free of fluorine, as recited in independent Claims 1 and 15. Accordingly, Applicant respectfully submits that Roberts does not cure the defect of Mu, Tsang and Kugimiya, and that independent Claims 1 and 15 are not obvious over Mu, Tsang, Kugimiya, and Roberts. Applicant further submits that Claims 9, 23, and 26-28 are not obvious over Mu, Tsang, Kugimiya, and Roberts because Claim 9 depends from Claim 1, and Claims 23 and 26-28 depend from Claim 15. Withdrawal of the 103 rejection to Claims 9, 23, and 26-28 is respectfully requested.

In view of the foregoing remarks, favorable reconsideration of all pending claims is requested. Applicant respectfully submits that this application is in condition for allowance and requests that a notice of allowance be issued. Should the Examiner believe that anything further is required to expedite the prosecution of this application or further clarify the issues, the Examiner is requested to contact Applicant's representative at the telephone number listed below.

Respectfully submitted,

PIPER RUDNICK LLP

A handwritten signature in cursive script, appearing to read "Michael Ye", written over a horizontal line.

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